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GB 2025557 A GB 1587469 A GB 1303723 A
EP 0241708 A US 4343399 A

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(71) Applicant
Exchem Plc

(Incorporated in the United Kingdom)

Commonwealth House, 1-19 New Oxford Street,
London, WC1A 1NU, United Kingdom

(72) Inventors
Paul Devonport
Frank Sumner

(74) Agent and/or Address for Service
Haseltine Lake & Co
Hazlitt House, 28 Southampton Buildings,
Chancery Lane, London, WC2A 1AT, United Kingdom

(54) Anchoring of fixing elements by settable material

(57) A fixing bolt (4) is anchored in a bore in a hollow and/or friable structure by means of a cylinder (20) which is cut to length and comprises perforations extending over its entire wall length, one open end of the cylinder (20) being closed by a cap (21) held thereon and the opposite open end being capped by a flanged member (23) held thereon and which is formed with an opening therethrough into the interior of the cylinder (20). Insertion of a fixing bolt (4) into curable resin injected into the cylinder (20) displaces resin through the perforations to form a body of curing resin around the cylinder (20). The cylinder (20) may be injection moulded, or wound and fused. The caps may fit *into* the cylinder ends.

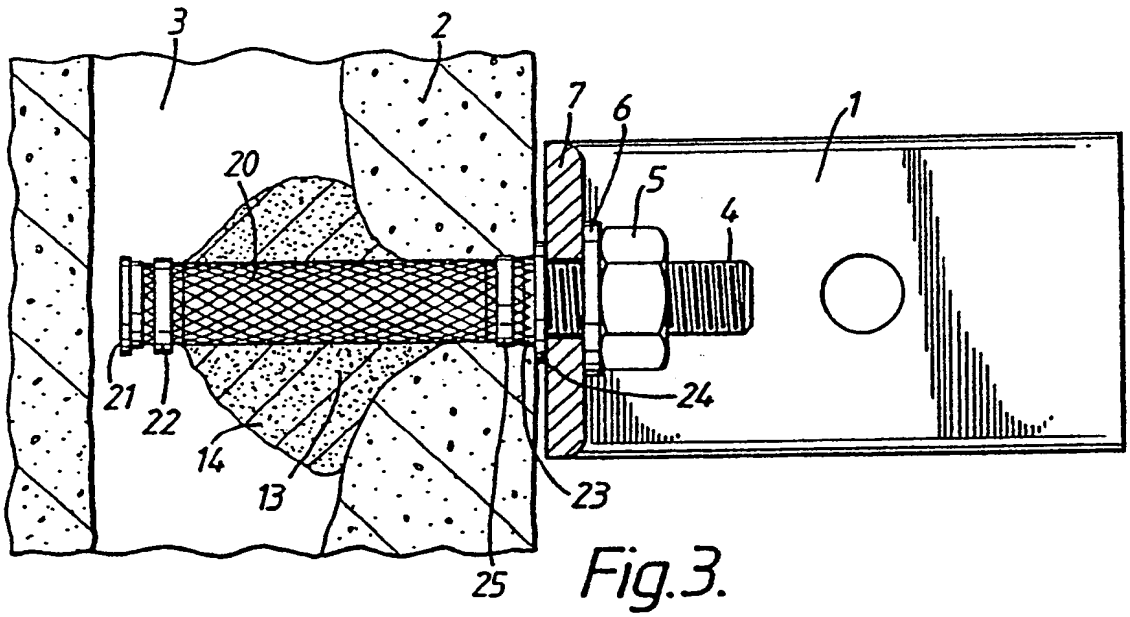

Fig.3.

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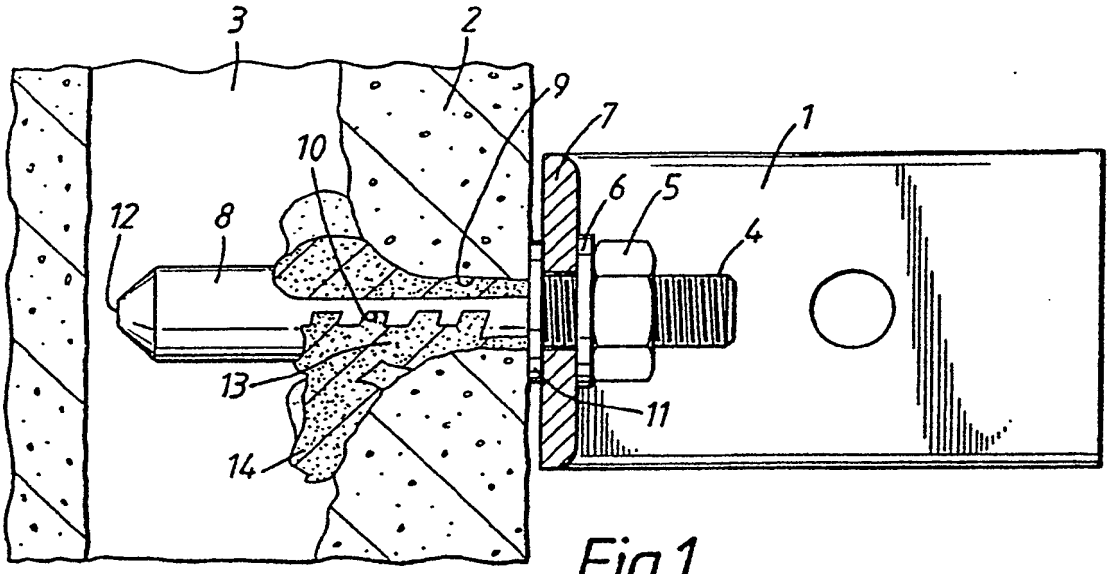

Fig.1.

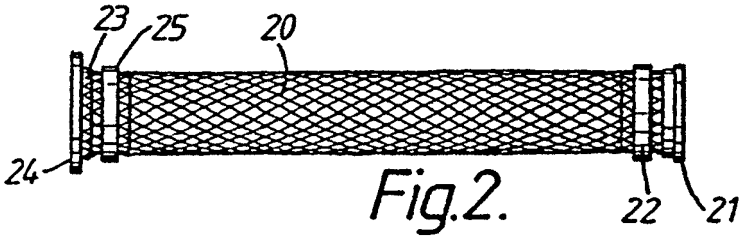

Fig.2.

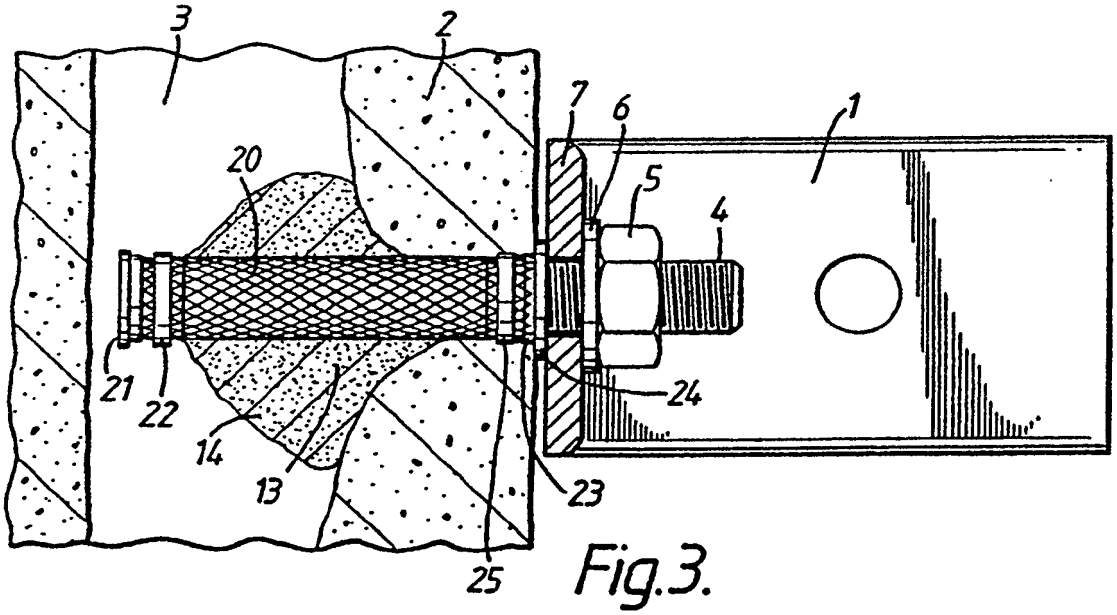

Fig.3.

Device for use in Anchor Bolting

This invention relates to the anchoring of fixing elements in a hollow and/or friable substrate.

Anchor bolting is a field of technology whose practice varies depending upon whether reinforcing or fixing elements are to be anchored and whether anchoring is to take place in a pre-drilled substrate which is formed of solid rock, such as an underground mine roof, or hollow or friable masonry such as formed from brieze block which may itself be hollow or be laid so as to form a hollow wall. Two principal non-mechanical methods of anchoring have been devised. One is based on hydraulic cement systems to be activated by water and the other on hardenable synthetic resin systems, generally a two component unsaturated polyester resin system. Where fixing in boreholes in solid rock is concerned and unsaturated polyester resin systems are to be employed, it is general practice for the reactive components of the system to be both packaged in a frangible cartridge, generally in separate compartments, and the cartridge is introduced into the borehole and then broken and the contents mixed <u>in situ</u> by means of a rotating reinforcing element to form a self-setting grouting composition around the reinforcing element.

This technique is not appropriate to anchoring of fixing elements in hollow and/or friable masonry wherein the countersupport of the wall of the pre-drilled bore hole is required in breaking the frangible cartridge to release the reactive components for mixing together.

In contrast thereto, systems for anchoring of fixing elements in hollow and/or friable masonry employ a two part resin injection anchor whose two chemical components are injected simultaneously into a perforated sleeve inserted into a pre-drilled opening in the masonry. The cure time of the mix of chemical components which is

formed is sufficiently long to allow a fixing element to be pushed into the sleeve to displace the mixture through the perforations through ram pressure so as to extend radially outwards and form a generally annular mass of cured resin. The diameter of this annular mass will be relatively restricted in the case of solid masonry of friable material which has nevertheless been unduly enlarged during pre-drilling. In the case of hollow masonry, this annular mass of resin will accumulate around the sleeve at internal surfaces of the masonry which extend parallel to the outermost surface of the masonry at which drilling was previously initiated and thus form a cavity retention means.

The sleeves themselves are generally of cylindrical form and restricted or possibly closed at the leading end and flanged at the trailing end. The sleeve may be formed in one piece by injection moulding with an appropriate array of perforations being provided in the cylindrical wall thereof. Alternatively it may be formed of a mesh tube formed as such and which is brought together and fused at its closed end. Sleeves of this type are described, for example, in GB-A-2,206,615.

The length of sleeve will depend upon the length of fixing element to be secured within the masonry and this will depend, in turn, on the size of element to be secured by the fixing element to the wall surface. Moreover, where hollow masonry is concerned, the disposition of internal wall surfaces in relation to an outer wall surface will vary from manufacturer to manufacturer of the blocks and/or on the position of external wall surfaces facing in the direction opposite to that faced by the surface at which the sleeve has been introduced. This necessitates having available a range of lengths of perforated sleeve. This is an inconvenience both from the point of view of stock which has to be held by a supplier and from the point of view of manufacture in that a range of moulds has to be

available for the manufacture of a range of sleeve sizes.

Thus not only are the manufacturing techniques for the fixed length sleeves relatively expensive to carry out, but inconvenience is introduced through the frequent need to have available a stock of sleeves for different uses.

It is an object of this invention to provide a means of overcoming the above difficulties.

According to one aspect of the invention there is provided a device for use in the anchoring of a fixing element in a hollow and/or friable substrate, the device comprising a cylinder which has been produced open at both ends and which comprises a plurality of perforations extending over its entire wall length, one end of which cylinder is closed by capping means held thereon and the opposite end of which cylinder is capped by a flanged member held thereon and which is formed with an opening therethrough into the interior of the cylinder.

According to a second aspect of the invention, there is provided a method for the manufacture of a device for use in the anchoring of a fixing element in a hollow and/or friable substrate which comprises cutting to a predetermined length an elongate cylinder which has been produced open at both ends and which comprises a plurality of perforations extending over its entire wall length, closing the cut cylinder at one end by capping means and capping the cut cylinder at its opposite end by means of a flanged member formed with an opening therethrough into the interior of the cut cylinder, the fitting of capping means and the flanged member to the respective ends of the cylinder being such that both are held on the respective ends of the cut cylinder.

In a third aspect, the invention provides for the use in the anchoring of a fixing element in a preformed bore in a hollow and/or friable substrate of a device according to the first aspect of the invention in a fixing procedure wherein a curable resin composition is

injected into the cylinder in place in the bore and, before curing of the resin has taken place, the resin is displaced through perforations in the wall thereof into free space around the cylinder on ramming of the fixing element into the interior of the cylinder.

The device of the invention may be a simple low-cost product produced by unskilled personnel at the point of use or off site from previously manufactured elongate perforated tubing and flanged capping members for insertion in the respective ends. The tubing itself may be an injection moulded product formed in an elongate mould with the required openings therethrough. It can also be formed as a lattice or netting structure by any technique conventional for use in the manufacture of plastics lattices or netting, being either produced cylindrically from the outset or as a flat lattice or netting product which is wound around a mandrell with its opposed edges being fused together. It should be appreciated that the term "perforation" is used in a wide sense herein to indicate not only structures in which openings are stamped in a solid wall but products in which a plurality of openings is formed in situ in a moulding process or net producing process. The tube itself may be formed of any convenient thermo-plastic plastics material for example polyethylene polypropylene, polyvinyl chloride etc.

The elements to be used at the respective ends of the tube may be preformed as injection moulded thermoplastic plastics products. The injection moulded otherwise produced elements may be inserted in the respective ends of the tube or fit over the ends as caps. The mode of utilization will depend upon the shape of these members and the means by which they are to be held onto the tube. When the tube is relatively flexible as when it is formed of a netting material, then it is most practicable for these members to be inserted into the ends of the tube and to be held thereon by a band.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made by way of example only to the accompanying drawings wherein:-

Figure 1 shows in cross section a hollow concrete block fixing showing sleeve fixing device, wall mounting and adhesive;

Figure 2 shows one form of fixing device embodying the invention;

Figure 3 shows the fixing device according to Figure 2 when used in like manner to the sleeve shown in Figure 1.

Referring to Figure 1 of the drawings, an angle member 1 is secured to a hollow concrete block 2 having a cavity 3 therein by means of a threaded bolt 4 with nut 5 and washer 6 which abuts a flange 7 of the angle member. An injection moulded cylindrical sleeve 8 extends into the cavity 3 through a pre-drilled bore 9 in the block. The sleeve is formed with a plurality of perforations 10 around its periphery in a zone extending from a flanged trailing end 11 to a little over half way towards a closed end 12. Adhesive 13 can be seen to have passed out of the perforations 10 in the sleeve 8 to occupy whatever free space exists between the sleeve and side of the bore, with adhesive from perforations located within the cavity 3 having been free to spread out further and form a holding ring 14 thereof prior to curing.

The fixing has been achieved as follows. The bore 9 is first formed in the friable material of the hollow concrete block 2. The sleeve 8 is then inserted into the bore as far as it will go, the insertion distance being restricted by the flanged end 11. A limit on the extent to which it may be inserted is imposed by the flanged trailing end 11. The sleeve will have been preselected as one having a length sufficient to enable it to extend into the cavity 3. A curable adhesive composition is then injected into the sleeve 8 which at this stage is

only loosely positioned in the bore 9. For this purpose, a two part curable polyester resin composition may be employed having a curing time once the components thereof have become mixed on entry into the sleeve 8 which is sufficient to enable the bolt 4 to be pushed freely thereinto. This will result in a ramming effect such that adhesive passes out through the perforations 10 to adopt a form as shown. The adhesive is allowed to cure and the solid holding ring 10 forming a continuation of a body of adhesive lining the bore 9 is formed with the bolt set in place in the thus cured adhesive. The angled member 1 can then be attached thereto using the nut 5 and intermediate washer 6.

Referring next to Figure 2 of the drawings, a sleeve fixing device embodying this invention and which is to replace the injection moulded sleeve 8 of Figure 1 is formed of a cut length 20 of preformed netting tube which is closed at one end by means of a plug 21 of injection moulded plastics material placed in intimate contact with the netting by means of a band 22 to ensure that it is held in place. Inserted in the opposite end of the tube 20 is an insertion member 23 which is a hollow tube surmounted by a flange 24 of greater diameter than the sleeve and the plug 21 at the opposite end. A band 25 holds the insertion member 23 in place in the tube. The device shown in Figure 2 will have been cut to a length sufficient for the intended purpose, and thus if used in the manner shown for sleeve fixing device 8 in Figure 1, could be cut to approximately the same length on site and equipped with members 21 and 23. The end closed by plug 21 will be equivalent to the closed end 12 of the sleeve fixing device 8 of Figure 1. A greater length of tube will be utilized if a longer bolt is to be employed therein and/or the wall thickness of the hollow masonry is greater than that shown in Figure 1. Conversely, shorter lengths of tube may be employed when circumstances demand. Obviously it is necessary for

there to be openings in the tube over the entire length thereof to enable sleeve fixing devices of any length to be formed therefrom whereas in Figure 1, it is merely necessary that the perforations will lie within a zone at which adhesive is required to pass out of the sleeve fixing device.

Thus referring finally to Figure 3, there is shown a modification of the arrangement of Figure 1 indicating the use of a fixing element of Figure 2. Like reference numerals denote like parts in Figures 1 and 2 and it can be seen that because perforations extend a greater length along the fixing element of Figure 2, adhesive tends to form a ball around the end of the sleeve rather than a ring. In all other respects, the utilisation of the sleeve fixing device of Figure 2 is the same as that of the sleeve fixing device 8 of Figure 1.

Claims:

1. A device for use in the anchoring of a fixing element in a hollow and/or friable substrate, the device comprising a cylinder which has been produced open at both ends and which comprises a plurality of perforations extending over its entire wall length, one end of which cylinder is closed by capping means held thereon and the opposite end of which cylinder is capped by a flanged member held thereon and which is formed with an opening therethrough into the interior of the cylinder.

2. A device as claimed in Claim 1, wherein the cylinder is an injection moulded product formed in an elongate mould with openings therethrough at intervals along the length thereof.

3. A device as claimed in Claim 1, wherein the cylinder is formed of a lattice or netting structure.

4. A device as claimed in Claim 3, wherein the cylinder is formed from which is wound around a mandrel and has its opposed edges fused together.

5. A device as claimed in Claim 1, wherein the cylinder is formed of thermoplastic plastics material.

6. A device as claimed in any one of Claims 2 to 5, wherein the cylinder is formed of polyethylene, polypropylene or polyvinyl chloride.

7. A device for use in the anchoring of a fixing element in a hollow and/or friable substrate, substantially as hereinbefore described with reference to and as shown in Figures 2 and 3 of the accompanying drawings.

8. A method for the manufacture of a device for use in the anchoring of a fixing element in a hollow and/or friable substrate which comprises cutting to a predetermined length an elongate cylinder which has been produced open at both ends and which comprises a plurality of perforations extending over its entire wall length, closing the cut cylinder at one end by capping means and capping the cut cylinder at its opposite end by

means of a flanged member formed with an opening therethrough into the interior of the cut cylinder, the fitting of capping means and the flanged member to the respective ends of the cylinder being such that both are held on the respective ends of the cut cylinder.

9. A method as claimed in Claim 8, wherein, the elongate cylinder is formed as a lattice or netting structure.

10. A method as claimed in Claim 9, wherein, the elongate cylinder is produced from a flat lattice or netting structure which is wound around a mandrel with its opposed edges being fused together.

11. A method for the manufacture of a device for use in the anchoring of a fixing element in a hollow and/or friable structure, substantially as hereinbefore described.

12. A method for the anchoring of a fixing element in a preformed bore in a hollow and/or friable substrate, which comprises providing in the preformed bore a device as claimed in any one of Claims 1 to 7, injecting a curable resin composition into the interior of the cylinder through the flanged member and, before curing of the resin has taken place, displacing the resin through perforations in the wall of the fixing element into free space around the cylinder as a fixing element is rammed into the interior of the cylinder.

13. A method of anchoring a fixing element in a preformed bore in a hollow and/or friable structure, substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

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(ii) Int Cl (Edition 5) F16B 13/14

Search Examiner
P M WELLER

Date of Search
17 MARCH 1993

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: EDOC

Documents considered relevant following a search in respect of claims 1-13

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2025557 A	(FOSROC) - Figure 1	1,3,12
Y	GB 1587469 A	(FISCHER) - Figure 5	1
Y	GB 1303723 A	(CELTITE) - Figures 1-3	1-3,5,6, 8,9,12
X	EP 0241708 A2	(INTEC) - Figures 2, 3	1,8,12
X	US 4343399 A	(PATEL) - Figure 2	1,3,5,8,9 12

Category	Identification of document and relevant passages	Relevant to claim(s)

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